UNITED STATES
PATENT APPLICATION

OF

VINCENT S. DARAGO AND CHRISTOPHER JENKINS

FOR

COMPUTER ARCHITECTURE
FOR MANAGING COURSEWARE
IN A SHARED USE OPERATING ENVIRONMENT

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RELATED APPLICATIONS

The present application claims priority to U.S. Patent Application Serial No. 60/079,302 filed March 25, 1998 ('302 application).

FIELD OF THE INVENTION

The present invention relates to content delivery over a large computer network, and more particularly to a computer network architecture which integrates management components such as a reservation system, a funds flow system, a metering system, and a security system for preventing unauthorized use of courseware and other content.

TECHNICAL BACKGROUND OF THE INVENTION

More and more paintings, pictures, books, songs, other performances, texts, diagrams, recordings, video clips, and courses utilizing them for instructional purposes and/or entertainment are becoming available in machine readable forms. In particular, many computer-assisted lessons, training materials, and other instructional courses include works which can be protected under intellectual property laws, such as visual works, audio works, texts, examinations, simulations, and other works. Some sensory works experienced while using computers, such as the physical motions performed with a flight simulator, may also be protected. Still other computer-aided sensory experiences are foreseeable but not yet commercially implemented, such as smells that could enhance a fire

fighting course or a course on the detection of illegal drugs. These will also benefit from protection.

"Computerized training", "computer-assisted instruction", "computer-aided learning", "web-based training", "intranet-based learning", "web courses", "virtual university", "computerized curriculum delivery system", "courseware delivery system", "instructional management system", "interactive educational method", and similar phrases are used by various people in various ways, but each of these terms refers to efforts to use computers to help educate students. As used here, "students" are not necessarily traditional students enrolled in high schools, colleges, universities, and the like, but are rather people who receive instruction through courseware. Courseware may be used by traditional students, but it may also be used by employees of government agencies and corporations, for instance.

To better understand the present invention in the context of existing computer-assisted educational efforts, it will helpful to understand certain distinctions, including without limitation the following:

- Course authoring vs. course content delivery;
- Stand-alone computer-based training vs. networked instruction;
- Synchronous sharing vs. asynchronous sharing;
- Commercial systems vs. academic systems; and
- Technical vs. legal means for securing intellectual property.
- Courseware vs. other content

Authoring vs. Delivery

Many uses of computers to facilitate education focus on providing authoring tools and authoring environments. For instance, tools for authoring include tools for re-

formatting text into HTML format and adding hyperlinks; tools for integrating audio and/or video content with text content; and tools for creating interactive forms to obtain information from students and provide appropriate responses. In short, authoring tools help instructors create courseware content.

5   By contrast, delivery tools help deliver courseware to students. In the case of "web-based training", "intranet-based learning", and "web courses", delivery tools typically include TCP/IP networks and web browsers. Computer workstations themselves may also be viewed as delivery tools, particularly when the courseware is written to be used on a stand-alone computer rather than being delivered over a network connection.

10   Many existing approaches to computer-aided teaching include both authoring and delivery components. However, the problems and solutions associated with authoring are not necessarily the same as those associated with delivery. The present invention is concerned primarily with delivery as opposed to authoring.

15   Stand-alone vs. Networked Instruction

Many computer-based training systems do not require a network connection in order to function. All necessary courseware content is stored on a computer disk, CD-ROM, or other medium which is directly accessible to the computer being used by the student, making it unnecessary to send any content over a network connection. The tools

20   and techniques for managing courseware content in such stand-alone systems are basically the same as the tools and techniques for managing application programs, operating systems, and other types of software installed on user workstations, namely written licenses, disk copy-protection schemes, license serial numbers, and the like.

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By contrast, network-based training approaches either take advantage of a network connection if one is available, or else they require such a connection. Different network-based systems use the network in different ways. Sometimes courseware content is stored on a server and delivered over the network to users as needed. In some cases,

5   part or all of the content is stored on the local network node but licensing is enforced through a server. For instance, the content stored locally might be encrypted, and the decryption key might be available only from the server and then only after the user is authenticated. Some network-based educational systems allow students to interact with one another and/or with the instructor through email or chat rooms. Some systems

10   administer tests by having the student send test answers to a server, which grades the test and notifies the student of the results. Some systems provide instructors with access over the network to a database of administrative information such as student grades and a list of the students who have viewed a given lesson. Of course, many systems combine one or more of these features and some also use networks in other ways.

15   The present invention is concerned with network-based courseware delivery systems, as opposed to stand-alone courseware delivery systems.

Synchronous vs. Asynchronous Sharing

Networked courseware delivery systems may share content between multiple users

20   synchronously or asynchronously. With synchronous sharing, users and/or instructors exchange information in a real-time or interactive way. Examples of synchronous sharing include telephone conversations, video conferencing, and chat rooms. By contrast, asynchronous sharing involves an exchange of information in which the participants expect

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substantial delays, or they involve a one-way flow of information rather than an exchange. Examples of asynchronous sharing include downloading a previously created multimedia presentation, listserv exchanges, and Usenet postings. Email does not fit neatly in either category, because it can be either synchronous or asynchronous in practice.

5   Some aspects of the present invention are concerned with asynchronous sharing, and in particular with asynchronous delivery of previously created courseware content. However, other aspects of the invention are concerned with synchronous information exchanges, such as funds transfers.

10   **Commercial Systems vs. Academic Systems**

As noted, some courseware students attend traditional institutions of higher education. In many cases, those students pay for their use of courseware by paying tuition to the institution. If the institution is not the owner of the courseware, the institution then makes separate arrangements for payment to the owner. Likewise, students who are

15   employees of a government agency or corporation generally receive access to courseware through their employer without personally making arrangements to pay the courseware owner directly. In either case, at the time a student sits down to actually use the course-ware it may be necessary to authenticate the student to the system but it is not necessary for the student to provide a credit card number or similar payment mechanism. For

20   convenience, courseware management systems which do not require direct payment from students are referred to herein as "academic systems".

By contrast, in "commercial systems" some provision must be made for funds transfer before a student is given full access to courseware content (although a demo

might be available at no charge). For instance, each student may be required to provide a credit card number, to pre-pay for access by giving cash or a check to an attendant, or to provide individual billing information if credit is being extended.

The present invention is concerned primarily with commercial courseware delivery

5   systems as opposed to academic courseware delivery systems.

Technical vs. Legal Security

As time passes, personal computers and other computational devices are able to record into machine readable form more and more complex presentations or experiences.

10   For example, personal computers in the 1980's mainly manipulated words, numbers, and characters; in the 1990's manipulation of icons, images, audio and video has become commonplace. The next step may include widespread use of motion, as in simulators, and perhaps smell or other additions. As the complexity of the process needed to place these words, images, and other sensory experiences into machine readable form increases, the

15   value of computer software that presents these experiences increases. This increases in turn the value of a security system which enforces courseware license agreements.

Intellectual property rights are provided by copyright and other laws to encourage creative effort by artists, authors, and other people who create paintings, photographs, animations, musical works, instructional texts, and other works. These works can be

20   stored, presented, and utilized in many ways. With the increasing availability of powerful computers, many works that were traditionally available on paper, canvas, or tape are now stored in computer hard drives and computer RAM (random access memory), and are

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displayed on computer monitors such as cathode ray tube screens and liquid crystal displays.

Early computers provided minimal technical security means. On early personal computers, for instance, typing "copy *.*" would direct the computer to copy every file or program in a directory. Further simple keystrokes, such as "copy C:/*.* A:/*.*" would direct the computer to place the new copies in a new physical location, perhaps copying everything from a disk directory in drive C to a portable disk in drive A. Even today most personal computers routinely provide an environment that makes it relatively easy to copy electronic information in the form of files.

Of course, technical means are not the only way to protect intellectual property rights; legal tools in the form of license agreements are widely used. Perhaps the most widespread license agreement is a single workstation agreement. In exchange for a license fee or an outright purchase price, a set of disks or a CD-ROM containing digitized works and/or executable code is transferred to the purchaser, often with books and/or instructions on paper. Sometimes the works are transferred over a network such as the Internet in digital form. The purchaser is typically informed that the code or information may be used an unlimited number of times on a single workstation or other computer.

This approach worked fairly well in the day of the stand-alone personal computer. It does require that the producer of the code or other protectable work place some trust in the buyer, since the buyer often could copy the code or information onto more than one computer. The barriers were mainly legal, not technical. In locations where intellectual property was not a well-established and respected concept, widespread copying of information and executable code reduced income and profits to producers of computer

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based information and applications by diverting income and profits to illicit "factories" which reproduced computer disks and CD-ROMs without permission from the rightful owner.

Many technical protection schemes were developed to combat the ability of the

5   market to reproduce information without payment to the owner. Some "copy-protection" schemes made it difficult to make copies, regardless of the legitimacy (e.g. for unauthorized resale versus for proper backup) of the copies.

Other schemes defined zones of control on a CD-ROM and made a "key" necessary to read the zones. For instance, if a CD-ROM had 600 megabytes of

10   information on it, a person might buy the legal right to see, view, or use 100 megabytes for $50.00. Information would be available in the first 100 megabyte zone regarding the contents and cost of information in the second or third 100 megabytes. For an additional fee or fees, the viewer could obtain the key to additional segments of the CD-ROM. For instance, a second $50 might buy the right to use the second 100 megabytes and a third

15     $50 fee might permit the use of the third 100 megabytes.

A problem with this approach (and with copy-protection schemes) is that once a single purchase has been made of all the information, or access to all the information on the disk or CD-ROM has been obtained once, the information could be reproduced at will. An unauthorized factory could produce thousands of copies to be resold with no benefit to

20   the rightful owner of the intellectual property.

Similar problems exist with the site license approach to protecting intellectual property. A licensed site such as a corporation or a government agency obtains the right to use a program or digitized information from the intellectual property owner, and is

given a set of disks, CD-ROMs, or file-server-based copies of the licensed work for authorized internal use. The intellectual property owner relies upon the corporation or agency not to share the information or program outside the bounds of the license. But the major tool for enforcing the license agreement was not technical. Instead, it was respect

5   for the law and the agreement. Unfortunately, some corporations and even some government agencies were staffed, at least in part, by people willing to take home a copy of the software or other licensed work and share it or sell it to an illegal copying factory.

Under a common relationship between works of intellectual property and the Internet, users view courseware and other information for free. The information is shared

10   for free because providing the information helps the work's owner sell a product, or saves the owner money by reducing technical support costs, for example. In the research community, huge sets of information are regularly exchanged via file transfer protocol or other digital means. Similarly, information in courses can be made available on the web, and can be viewed via a browser.

15   The present invention relates to protecting content both by technical means and by legal mechanisms. Although some information may be shared for free within a system according to the invention, much of the information available through the inventive system is provided only in exchange for license fees or the like paid by students or their employers.

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Courseware v. Other Content

Those of skill in the art will recognize that many of the comments above apply not only to courseware, but also to other types of digital content, including without limitation

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musical recordings, visual images, and the like. Such content may appear as components

of multimedia courseware, but it may also be distributed independently of courseware

and/or for purposes other than education. As used herein, "content" includes both

courseware and other kinds of digital content.

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Additional Considerations

In addition to the considerations above, certain trends are worth noting. Many

courses are available on the web, yet in general the more attractive the course is (visually,

in activity, motion, video, sound, and so on), the more time it takes to refresh the

10   computer screen at the user's workstation. To reduce download time, more and more

bandwidth is requested. Users go from a POTS ("plain old telephone system") line, to an

ISDN line to a T1 line, with increasing costs at each stage. However, the cost of

computer storage is dropping rapidly. As most machine readable classes remain less than

a gigabyte in size, the cost of forward storing a machine-readable class to the personal

15   computer owner wishing to take the class is dropping rapidly.

As the speed of market developments in the computer industry increase, the delay

and cost of obtaining legal remedies increase, and the technical ease of copying and

distributing electronic information increases dramatically with the interconnections

available via the Internet, improved tools for managing courseware are needed.

20   As discussed above, a wide range of computer-assisted educational features and

capabilities have been explored, at least to some extent. However, existing approaches

have been less successful at combining these features and capabilities into an architecture

which securely and effectively shares commercial courseware. Accordingly, it would be

an advancement in the art to provide an improved computer architecture for sharing commercial courseware and other content over a network.

BRIEF SUMMARY OF THE INVENTION

5   The present invention provides improved capabilities for managing courseware and other content in a shared use operating environment such as a computer network. In particular, the invention provides a commercial networked content delivery method and system which does not exclude synchronous sharing but is focused on asynchronous sharing.

10   One method of the invention operates in a network containing a registration server, a content server connected to the registration server, and several client work-stations connected to the content server. After a user registers with the registration server and requests access, the content server authenticates the request and serves the content to the client workstation for presentation to the user. Content may be moved by the system

15   between content servers in response to actual or anticipated user requests; users may reserve courses for later viewing. If the target content server lacks room to receive the incoming content, the system makes a recommendation to the local administrator as to which content should be deleted from the content server in order to make additional room.

Courseware and other content managed by the system may contain one or more

20   "critical portions" which have been treated to prevent their unauthorized use and thereby enhance the protection of intellectual property rights in the content by technical means. For example, the treating step may insert disabling code into an executable portion of courseware, may encapsulate the critical portion in a database table, may compress the

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critical portion, and/or may encrypt the critical portion. In addition, the content server and/or client workstation may disable use of a critical portion if an expected security handshake is not received. Caching and other disk writes at the client may also be disabled to prevent a permanent copy of the critical portion from being created at the client. To take advantage of low cost telephone connections, part or all of the content may be downloaded to the client workstation one or more hours before serving the critical portion.

The system also monitors the connection between content server and client, and meters use of the content so that the user pays only for actual use. Pre-existing works can be metered without being modified. In some cases, however, a metering security module is injected by linking or recompilation into the machine readable form of a work that contains legally protectable intellectual property. Adding the metering security module alters the system, such as by inserting disabling code, so that the system will not play or display the content unless the metering security module is operating. "Playing" a work includes displaying it, executing it, digitally manipulating it, or otherwise performing an act governed by the license agreement or by relevant intellectual property law. Unless the metering security module is engaged and authorizes the use, a monitor will not display certain protected words or images or motion images, speakers will not play certain protected sounds, motion simulators will not perform certain protected motions, and so forth.

The user receives an invoice for use of the courseware or other content. A local administrator can be authorized to adjust invoices in response to user requests. For instance, the administrator may determine that the user did not finish viewing the course in

question, or accidentally started the wrong course, and then reduce the charges on that basis. If the user previously provided a credit card payment authorization to permit payment by credit card, a funds flow manager makes appropriate adjustments to the credit card charges.

5   In short, the architecture of the present invention provides improved security, efficiency, and convenience for the management of courseware or other content in a shared operating environment such as a network or a collection of loosely coupled networks. For instance, additional security is provided by separating registration information from content, by identifying and treating critical portions, and by monitoring

10   the connection over which content is supplied to a client. Convenience and efficiency are provided by optional early downloading, by reservation capabilities, and by a combination of automatic and local administrator control. Additional features and advantages of the present invention will become more fully apparent through the following description.

15   BRIEF DESCRIPTION OF THE DRAWINGS

To illustrate the manner in which the advantages and features of the invention are obtained, a more particular description of the invention will be given with reference to the attached drawings. These drawings only illustrate selected aspects of the invention and thus do not limit the invention's scope. In the drawings:

20   Figure 1 is a diagram illustrating a network architecture according to the present invention, including a registration server, several content servers, and several clients.

Figure 2 is a diagram further illustrating a portion of the network architecture of Figure 1, including a content server and several clients.

Figure 3 is a diagram further illustrating a registration server.

Figure 4 is a diagram further illustrating a content server.

Figure 5 is a diagram further illustrating a client of a content server.

Figure 6 is a flowchart illustrating methods of the present invention, including

5   steps for providing enhanced security to protect intellectual property rights in critical

portions of content.

Figure 7 is a flowchart illustrating methods of operation in the present invention,

from the point of view of a courseware user.

10   **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

The present invention relates to methods, systems, and configured storage media

for managing courseware and/or other content in a shared use operating environment.

Courseware includes digital instructional and/or entertainment content in the form of

software, digitized sounds, digitized images, digitized motion paths, digitized chemical

15   compounds, and other works which can be transmitted over a computer network for

presentation to a user and which contain intellectual property that is protectable by

copyright, patent, trade secret, trademark, trade dress, moral rights, common law rights,

contract, and/or other sources of legal authority. Courseware is sometimes referred to

herein as a "course" or "class" or "work" or "content"; "content" and "work" are used

20   interchangeably to describe material of which courseware is just one example. Specific

examples of courseware and other content are given to illustrate aspects of the invention,

but those of skill in the art will understand that other examples may also fall within the

scope of the invention.

A shared use operating environment is an environment in which more than one

person can use content, without necessarily sharing a specific copy of that content, with

the assistance of a computer network or a collection of coupled networks. As used here,

"network" includes local area networks, wide area networks, metropolitan area networks,

5   and/or various "Internet" networks such as the World Wide Web, a private Internet, a

secure Internet, a value-added network, a virtual private network, an extranet, or an

intranet.

Overview of the Architecture

10   Figure 1 illustrates generally an architecture 100 of a shared use operating

environment according to the present invention. The architecture 100 includes at least

three levels which are defined according to the functionality and data that are present

and/or intentionally omitted from each level. Those of skill in the art will appreciate that

the levels may be being named differently in various embodiments, but for clarity they are

15   referred to herein as a registration server level 102, a content server level 104, and a client

level 106.

The registration server level 102 includes at least one registration server 108. The

functionality and data associated with the registration server(s) 108 are described in detail

below. At this point, it is sufficient to note that each registration server 108 includes a

20   remote registration manager and a registration database for new user registration, and that

each registration server 108 is free of courseware or other deliverable content that is

managed by the architecture 100. In particular, courseware is not stored on the

registration server 108.

The content server level 104 includes at least one content server 110. For clarity of illustration, three content servers 110 are shown, but an embodiment of the invention may include one or more servers 110. Each content server 110 is linked by a link 112 for network communications with a registration server 108. In an embodiment containing a

5   single registration server 108, such as the embodiment illustrated, each content server 110 thus has a network connection 112 (or may readily obtain such a connection) to that registration server 108. In embodiments containing more than one registration server 108, different content servers 110 may communicate over one or more network links 112 with one or more of the registration servers 108. Each network link 112 may involve a

10   dedicated link, a virtual circuit, a tunnel through one or more intervening networks, or one or more other types of network communication links known to those of skill in the art.

Each content server 110 contains courseware and/or other works managed by the architecture. Like the registration server 108, a content server 110 may also contain data which is not managed by the architecture and which is thus of no concern here unless it

15   interferes with operation of the system 100. Each content server 110 serves the managed content for presentation to registered users, that is, users who have previously been registered with the registration server 108. At a minimum, registration provides users with a unique user name or user ID; it may also coordinate a password or otherwise manage access control. With the possible exception of registration for free

20   demonstrations, which may be available in some embodiments, registration also obtains billing or payment information such as the user's credit card information, purchase order, and/or sponsor identity.

The registration server 108 and the content server(s) 110 may be implemented

with a combination of computer hardware (e.g., disk or other non-volatile storage, RAM

or other volatile storage, one or more processors, network interface cards, supporting I/O

equipment) and computer software (e.g., operating system software, networking software,

5   web browser software, and inventive software as described herein). In particular, suitable

software for implementing the invention is readily provided by those of skill in the art

using the teachings presented here and programming languages and tools such as Java,

Pascal, C++, C, CGI, Perl, SQL, APIs, SDKs, assembly, firmware, microcode, and/or

other languages and tools. A given computer may host several content servers 110, or it

10   may host several registration servers 108, but a content server 110 and a registration

server 108 may not reside on the same computer because that would violate the

requirement that registration servers 108 not contain courseware.

The client level 106 includes at least one client workstation 114, and typically

includes multiple workstations 114. Each client workstation 114 is connectable to a

15   content server 110 by a client-server network communications link 116, such as a local

area network link. At some point, each client workstation 114 is able to present, to at

least one registered user, courseware and/or other content which is served over the link

116 by the content server 110. The content may be conventional content, or it may be

modified by treating critical portions as described herein, or it may be a combination of

20   untreated and treated works. Although clients 114 are referred to as workstations in

deference to the expected typical situation, it will become clear that laptops and other

computers may also serve as clients 114.

Registration servers 108, content servers 110, and clients 114 are further

illustrated in Figures 3, 4, and 5, respectively. However, before describing those three

Figures the relationship between content servers 110 and clients 114 is discussed with

reference to Figure 2, and the relationship between registration servers 108 and content

5   servers 110 shown in Figure 1 is described in greater detail.

A Network of Content Servers and Clients

Figure 2 further illustrates one of many possible client-server networks 200

suitable for use according to the invention. The network 200 includes one content server

10   110 and four clients 114. Other suitable content-server-client networks 200 may contain

other combinations of content servers 110, clients 114, and/or peer-to-peer nodes which

perform as content servers 110 and/or clients 114 according to the invention; with

appropriate software, a given computer may function both as a client 114 and as a server

110. The computers 110, 114 connected in a suitable network 200 may be workstations,

15   laptop computers, disconnectable mobile computers, uniprocessor or multi-processor

machines, mainframes, so-called "network computers" or "lean clients", personal digital

assistants, or a combination thereof. Nonvolatile storage 202, printers (not shown), and

other devices may also be connected to the network 200.

The network 200 may include communications or networking software such as the

20   software available from Novell, Microsoft, Artisoft, SCO, and other vendors, and may

operate using TCP/IP, SPX, IPX, and other protocols over connections 116 that include

twisted pair, coaxial, or optical fiber cables, telephone lines, satellites, microwave relays,

modulated AC power lines, and/or other data transmission "wires" known to those of skill

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in the art. The network 200 may encompass smaller networks and/or be connectable to other networks through a gateway or similar mechanism.

As suggested by Figure 2, at least one of the computers 110, 114 is capable of using a floppy drive, tape drive, optical drive, magneto-optical drive, or other means to

5   read a storage medium 204. A suitable storage medium 204 includes a magnetic, optical, or other computer-readable storage device having a specific physical configuration. Suitable storage devices include floppy disks, hard disks, tape, CD-ROMs, PROMs, random access memory, and other computer system storage devices. The physical configuration represents data and instructions which cause the computer system to operate

10   in a specific and predefined manner as described herein. Thus, the medium 204 tangibly embodies a program, functions, and/or instructions that are executable by computer(s) to assist content management generally, and license enforcement in particular, substantially as described herein. As used herein, "executable" includes "interpretable"; executable code thus includes compiled code as well as codes like Java byte codes or interpreted BASIC

15   statements.

A Network of Registration Servers and Content Servers

As noted, the network 200 involves at least one content server level 104 computer and one or more client level 106 computers 114. Some of the characteristics of the

20   network 200 may also apply to networks, such as that shown in the upper two-thirds of Figure 1, which involve the registration server level 102 and the content server level 104.

For instance, the computers 108, 110 may be workstations, uniprocessor or multi-processor servers, mainframes, or a combination thereof such as a cluster. Nonvolatile

storage such as a disk array and/or other devices may be connected to the computers 108, 110. The computers 108, 110 may be linked by communications or networking software such as the software available from various vendors and may operate using TCP/IP and/or other protocols over connections 112 that include data transmission "wires", as described above. The computers 108, 110 may likewise be part of a network which encompasses smaller networks and/or is connectable to other networks. Finally, the computers 108, 110 may be capable of using a drive or other means to read a configured storage medium 204.

One example of a network 200 suitable for a metered security relationship is a network holding several thousand machine readable courses. A conventional approach charging one fee for unlimited use of each machine readable course by a single personal computer 114 or a single location (e.g., a corporation or agency) would be prohibitively expensive. In an embodiment according to the invention, the secured courseware or other content can be shared by various users, and each minute of use is counted and billed to the user or to the sponsor of the user (e.g., the corporation or agency employing the user). Unlimited use is not required, and the license fee is reduced accordingly.

Registration Server

Figure 3 further illustrates a registration server 108. The registration server 108 includes at least a portion of a registration manager 300 and of a corresponding user registration database 302. Collectively, the manager 300 and the database 302 form a registration module which provides at least unique user IDs and user password support. The registration module may also obtain and store in the database 302 information such as

the identity of a corporate or government sponsor that employs the user, and the user's email address for use in notifications of upcoming services or events.

The proposed user ID and password are checked against existing registration information in the database 302 to make certain they are unique throughout the architecture 100 embodiment. This provides security to users so that charges for services will be valid and services cannot be stolen by an unknown or duplicate user and then charged to the wrong user ID. Of course, users must still be careful to keep their own password information confidential and to choose passwords which are not simply a copy of their username or other easily guessed information. User login and authentication tools and techniques familiar to those of skill in the art may be used.

Security is enhanced by making all new registrations go through the registration server 108. New user registration information is processed on the registration server 108; user registrations cannot be created by any content server 110. The updated registration database 302 is replicated in a read-only format to content servers 110 so they can recognize registered users, but a new user registration cannot be created directly on a content server 110. One advantage of this approach to users is that they need not repeat registration information each time they log onto a client 114. Registration database 302 replication may be performed using Oracle 8.0 enterprise software or other familiar means.

As illustrated in Figures 3 and 4, in one embodiment of the architecture 100 a portion of the registration module resides on each registration server 108 and a portion resides on each content server 110. Other embodiments may distribute registration module functionality differently between the three levels 102, 104, 106, subject to the appended claims. Those of skill in the art will readily implement the registration manager

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300 based on commercially available tools and languages such as C++ or Java and the description given herein. The database 302 may likewise be implemented as an Oracle database or in another familiar database format. In one embodiment, Java software in the registration manager 300 is used to write new user registration information to an Oracle

5   database 302.

The registration server further includes a reservation manager 304 and a reservation database 306. Collectively, the manager 304 and the database 306 form a reservation module which permits registered users to reserve courseware or other content. In combination with the funds flow system described herein, the reservation module allows

10   a user to book a guaranteed seat, a classroom, or another service, secure in the knowledge that it will be held for them until the specified time. In some embodiments, the funds flow system will charge users for such guaranteed resource reservations regardless of whether the resource is actually used, because the resource was kept unavailable for use by others. The reservation module can present a user with a menu or a schedule of courseware

15   presentation events in various classrooms or other locations. It can also tell the user whether a given courseware event or piece of content is available at a given time and whether a particular work is already scheduled for use at that time.

Other embodiments may distribute reservation module functionality differently than shown between the three levels 102, 104, 106, subject to the appended claims. In one

20   embodiment, the reservation module includes commercial off-the-shelf scheduling software provided by AC&E Ltd. of Chantilly, Virginia; in other embodiments, other scheduling software may be used. The reservation manager 304 may also be implemented using commercially available tools and languages such as C++ or Java and the description

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given herein. The database 306 may be implemented as an Oracle database or in another familiar database format.

The illustrated registration server 108 also includes at least part of a funds flow manager 308 which manages content usage payment information. As illustrated in Figures 3-5, in one embodiment of the architecture 100 a portion of the funds flow manager 308 resides on each client workstation 114, a portion resides on each content server 110, and a portion resides on each registration server 108. Other embodiments may distribute funds flow management functionality differently between the three levels 102, 104, 106, subject to the appended claims.

The funds flow manager 308 accepts payment information such as a purchase order number or a credit card authorization. If payment is to be made by credit card, the funds flow manager 308 places a hold with the credit card provider or bank before the courseware and/or other content is presented. In connection with sending the user the final invoice, the funds flow manager 308 contacts the bank to transfer funds from the user's account or the sponsor's account to the service provider's account or the content owner's account.

The funds flow manager 308 makes customer interactions with the system 100 faster and more effective. For example, upon first using the system 100, the user may provide a billing code such as a corporate purchase order number or credit card number. Once this information is accepted by the funds flow manager 308, the user may make it the default payment option to be applied when logging out after future service purchases.

The funds flow manager 308 may also provide a custom menu to users. For instance, the system 100 may be configured so that only courses approved by a particular

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entity are displayed if the user identified that entity as its sponsor while signing on. If this same user wishes to see other courses, the user may log out and then login again as an individual client, after which all courses available for individuals (whether employed by the sponsor in question or not) will be displayed as possible selections.

5   The illustrated registration server 108 also includes at least part of a content movement manager 310 which moves courseware and/or other content to content servers 110 in response to actual or anticipated requests from users for access. As illustrated in Figures 3 and 4, in one embodiment of the architecture 100 a portion of the content movement manager 310 resides on each content server 110 and a portion resides on each

10   registration server 108. Other embodiments may place all content movement management functionality at the content server level 104.

The content movement manager 310 interacts with scheduling software such as the reservation module and a launch manager 404 which is discussed below. When a user selects courseware and/or other content for use at a given location, the scheduler

15   determines whether the content is already resident on a content server 110 at or near the requested location. This determination may be made by reference to a database which tracks content locations, or by making an inquiry to the local content server(s) 110.

If the content is not resident at the desired location, the scheduler places a call to the content movement manager 310. The content is automatically packaged for shipment

20   from another content server 110 by FTP (file transfer protocol) or other familiar means, with appropriate encryption and/or compression. The source content server 110 may be a typical content server 110 as described above, or it may be a master content server 110. Each master content server 110 serves primarily as a content repository for other content

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servers 110, as opposed to serving primarily as a source of content for directly attached clients 114.

The content movement manager 310 checks with the target content server 110 to determine whether sufficient disk space is available to receive the incoming content. If there is not enough space, the content movement manager 310 makes a recommendation to a local administrator regarding which content to delete to make room for the incoming content. The recommendation may be based on various factors, including storage requirements and which courseware at the target server 110 was used most recently or is scheduled for use. For instance, if a course has not been used for several months and has not been reserved, the content movement manager 310 is more likely to recommend that it be deleted than if it was used more recently or has been reserved. In one embodiment, the content movement manager 310 cannot delete content; only the local site administrator can.

Some embodiments of the architecture 100 include a backup registration server 108 which contains data mirrored from the primary registration server 108 shown in Figure 1. As usual with mirrored systems, the backup server 108 will generally be in a different physical location than the primary server 108. Data mirroring tools and techniques familiar in the art may be used.

In addition to the functionality described above, the registration server 108 may provide advertising and other inducements for Web walkers and potential users of the system 100 to become familiar with the system 100, and to register for services provided through the system 100.

Content Server

Figure 4 further illustrates a content server 110. The content server 110 includes operating system software and networking software, such as Windows NT operating system software, UNIX or Linux operating system software, Ethernet or NetWare

5　networking software, and/or other software discussed in connection with Figure 2.

Unlike the registration server 108, the content server 110 contains courseware and/or other managed content 400. The content 400 may take a variety of forms, including software, video, audio and other types of digital content. The content 400 may also be treated according to the present invention by identifying critical portions and

10　providing enhanced security for those portions. Security for the content 400 as a whole is also provided by a security manager 402, which monitors use of the content 400. In the illustrated embodiment, a portion of the security manager 402 resides on each client workstation 114 and a portion resides on each content server 110. In alternative embodiments, the security manager 402 may reside entirely on the content server 110 or

15　entirely on the client 114.

As illustrated, a portion of the registration manager 300 resides on the content server 110. At the content server level 104, the registration manager 300 only needs to recognize registered users and provide them with access to content 400. New users are created at the registration server level 102. In one embodiment, the registration manager

20　300 includes dynamic HTML and/or commercially available Oracle Web Application Server software, from Oracle Corporation of Redwood Shores, California. Use of the Oracle software may require that a portion of the registration manager 300 also reside on each client 114 and/or on the registration server 108.

Critical portions of the content 400 may reside in database tables managed by the security manager 402. For example, executable portions of content or synchronization information for coordinating audio and video in content may be stored in a database table. Database table names do not necessarily reflect content in the straightforward manner in which more typical content file names can reflect file content. Also, database tables may be difficult to access directly through the file system; it may be necessary to go through the database management software. Accordingly, placing content 400 in database tables tends to make it more difficult for unauthorized users to locate and use the content 400.

In addition, when content 400 is moved between computers (be they clients 114, servers 110, or a mixture), critical portions of the content 400 may be divided between two or more data tables so that theft of any single data table will not provide satisfactory service. As a further precaution, in one embodiment the security manager 402 sends one or more critical portions of content (possibly in data table format) only to a client 114's volatile memory rather than sending all critical portions to nonvolatile memory such as a client 114 disk. Critical portions sent only to client 114 RAM may be scrambled or erased when the client 114 shuts down or is rebooted, making it even more difficult to make illicit copies of the content 400.

Each illustrated content server 110 also includes a launch manager 404 for launching presentations of courseware 400. The launch manager 404 coordinates initial activity such as course 400 selection by the user, any necessary course 400 movement to bring the course 400 to the server 110 using the content movement manager 310, initializing security arrangements with the security manager 402, making the network connection 116 if necessary, and initiating presentation of the course 400 by launching its

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executable portion or downloading it to the client 114, for instance. In alternative

embodiments the launch manager 404 functionality is part of a meter manager 406 or part

of the security manager 402.

The meter manager 406 meters content usage. In some embodiments, the

5 metering manager also monitors the connection 116; in other embodiments monitoring is

performed by the security manager 402. Regardless, the metering manager 406 keeps

track of elapsed time as a measure of the user's use of the content. A portion of the meter

manager 406 resides on each client workstation 114 and a portion resides on each content

server 110. The two portions of the meter manager 406 create a link which is carried over

10 the connection 116. That is, the metering link rides on top of an Ethernet or other

conventional communications link.

In one embodiment, the meter manager 406 creates a start note (event) when

courseware is successfully launched. The meter manager 406 will associate this start note

with a corresponding end note within one minute (or other defined interval) of the time the

15 user chooses to finish this course 400 presentation. The difference in time between

launching the presentation and finishing or interrupting the launched presentation is the

metered difference, which will serve as the basis for the invoice presented to the user or to

the user's sponsor.

The meter manager 406 may track several open notes for a given client 114, since

20 clients 114 may use operating system software that allows several executables to run at

the same time. Metering statistics may be administered using an Oracle database 408 or

other database 408 to provide system-wide statistics and system-wide information reports.

In one embodiment, meter manager 406 records are constructed in a format that allows

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their use in conjunction with a rate table, thereby allowing the funds flow manager 308 to create an invoice based on both the particular content 400 used and the elapsed time.

Every rate in the rate table may be associated with a destination account, such as the account of a content 400 vendor or the account of a content-providing site 200

5   manager. The funds flow manager 308 supports automatic payment using familiar and industry standard credit card payment methods. The funds flow manager 308 accepts electronic billing information from the meter manager 406, and accepts electronically stored payment information such as credit card numbers from the registration module.

The meter manager 406 and/or security manager 402 provide several security

10   features. First, the client 114 desktop is disabled so that the user can only obtain service through the metered and monitored connection 116. Second, each element of potential service such as multimedia content, executables, and courseware tests, is defeated so that its executable portion will not run even if it is located by an unauthorized user. The executables are modified to require security handshakes from the meter manager 406

15   and/or security manager 402 so the service 400 will not operate at all, or will operate for only a limited period of time, if the metered connection 116 or the meter manager 406 and security manager 402 are not present.

In one embodiment, the client 114 desktop will turn off if the meter manager 406 on the client 114 is not in touch with the meter manager 406 on the content server 110 on

20   a minute-by-minute basis. For the convenience of the user and to ease administration of the system 100, the meter manager 406 can be adjusted to invoke this "dead man's switch" at various time intervals other than one minute. An aggressive approach makes

the workstation 114 freeze if a single minute passes with no contact. A more lenient

approach may freeze functionality within five minutes after the connection is lost.

In one embodiment, the same polling software element in the meter manager 406

which triggers the dead man's switch also provides a periodic update to the database 408

5   that is used by the funds flow manager 308 for billing. Each minute that the polling

function of the meter manager 406 returns a message from the client 114 to the server 110

indicating that the user ID remains active on the client 114, the database 408 is updated to

reflect an additional minute of use for billing purposes.

Polling updates each open request, such as each open courseware presentation.

10   For instance, if in the first minute the user ID requests a login and then makes one open

service 400 request, an open event is updated for this user ID in the database 408 table for

the time elapsed. If the same user ID then requests a second courseware 400 presentation,

each courseware 400 event ID is associated with the login by this user and this client

desktop 114, and two time events occur to update the database 408. Thus, subsequent

15   courseware or other service offerings which are opened in the client 114 browser 502 can

be added to the time table in the database 408 using the same polling function. The

polling function operates similarly for sequential (as opposed to concurrent) activity. If

the user ID for a given login closes a courseware presentation 400 or other event ID but

retains the login, then while the login time continues to update (enabling billing for use of

20   the personal computer 114), the first courseware 400 offering will end and a new

courseware 400 offering can begin during the same login session.